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The effect of verbal labeling in a serial position short term memory task was investigated. Forty female college students were given 16 trials each. Eight trials involved only central items which had to be recalled. The other eight trials involved both central and incidental items. Half of the subjects verbalized the names of the central items as they were presented. Verbalization was found to decrease short term memory performance. There was no effect of one versus two stimuli per card. The authors feel that these results supplement the past research in this area and support a view that with age the use of rehearsal strategies becomes increasingly dominant. Consequently, labeling inhibits the use of more efficient processing. This paper comprises a report in "Development of Language Functions, a Research Program-Project (Study M: Development of Selective Attention Abilities)." (DO)

The University of Michigan

Center for Human Growth and Development

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Abstract

The effect of verbal labeling in a serial position short-term memory task was investigated. Forty college students were given sixteen trials each. Eight trials involved only central items which had to be recalled and eight trials involved both central and incidental items. Half of the Ss verbalized the names of the central items as they were presented. Verbalization was found to decrease short-term memory performance ($F = 5.163$, $p < .05$). There was no effect of one versus two stimuli per card ($F < 1$). The findings were discussed in terms of developmental studies concerning verbal labeling and information processing.

Verbal Labeling and Serial Position Recall

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Performance on a variety of cognitive tasks has been demonstrated to be affected by induced verbal labels, but the relation is not a simple one (Kendler, 1963). Recent investigations of short term memory (STM) have shown that verbal labeling has differential effects at different chronological ages (CA) in children and have also clarified the nature of the mediating mechanisms (Hagen and Kingsley, 1968; Flavell, Beach and Chinsky, 1966). The mediational deficiency hypothesis (Reese, 1962) has often been invoked to explain why labeling did not facilitate performance in children at young ages. However, this hypothesis left many questions unanswered, and the present study pursues some of these.

The mediational deficiency hypothesis states that there is a state in development during which verbal responses are present but do not serve as mediators. Recently Flavell and his colleagues (Flavell, Beach and Chinsky, 1966; Keeney, Cannizzo, and Flavell, 1967) have argued that there is a production deficiency in young children; if labels are produced, either spontaneously or under experimental inducement, then mediation occurs and performance is facilitated, at least in STM tasks. Hagen and Kingsley (1968) have studied verbal labeling effects in serial STM tasks and found that at certain ages there is a facilitating effect, but at either younger or older ages no such effect occurs. However, serial-position analysis of the data demonstrated that there is a very striking serial-position x verbal labeling x age interaction effect. At the recency portion of the curve, performance is consistent across the age range from six to ten years: labeling facilitated performance and there was no improvement with CA. However, the picture is different at the primacy portion: performance improved with CA, but by age ten labeling resulted in significantly lower STM performance. A follow-up study extended the CA range to a

mean of twelve years and also introduced another variation, central versus incidental recall measures (Hagen and Meacham, 1967). In older Ss no overall labeling effect was found, but the serial position data replicated the earlier study. Thus in a serial position STM task labeling affects which items are recalled.

We hypothesized that by age ten children have developed strategies which consist of rehearsing the names of the items already exposed during the intertrial intervals. Labeling disrupts these strategies by interfering with rehearsal. Since rehearsal facilitates primacy learning (Postman, 1964), and labeling inhibits rehearsal, labeling reduces primacy performance. Labeling heightens the saliency of recency items, perhaps by placing the label in immediate memory store; hence performance is facilitated for these items. Several studies by other investigators support the notion that a serial position STM task involves two distinct memory processes, very short-term and longer term (Kausler, 1966; Ellis and Hope, in press; Glanzer and Cunitz, 1966).

The present study was designed to test more definitively the hypothesis concerning labeling effects. It was expected that adults would show an actual overall deficit due to labeling since they should engage in more rehearsal than the children previously studied. The deficit should appear in the serial position analysis on all but the most recent item. The paradigm was also modified so that the learning of incidental items could be measured under label and no label instructions. Earlier studies had indicated that an incidental measure in STM tasks can provide an index of the efficiency of information processing under various experimental conditions (Hagen, 1967; Hagen and Sabo, 1967). Thus the design was as follows: a STM task was administered to adult Ss; for half of the trials overt labeling of the stimulus items was required and for the other half no labeling was required; half of the Ss were presented only the to-be-remembered items, half of the Ss were presented an incidental item with each central stimulus item.

Method

Subjects: The Ss were forty females from introductory psychology courses at The University of Michigan. Ss were divided at random into either a label or no label group.

Each S was tested in two conditions, a one stimulus item per card and a two stimulus items per card condition. Scores on the Scholastic Aptitude Test (SAT) were available for 35 of the Ss.

Stimulus Materials: All Ss were presented with two series of eight trials, eight cards per trial. Stimulus cards were white 3" x 5" cards. In the two stimulus items condition each card had two black line drawings, one above and just touching the other. On four cards an animal was the top drawing and a household object was the bottom drawing; on the other four cards this order was reversed. The pairs were as follows: fish-telephone, cat-lamp, horse-chair, camel- television, monkey-book, bear-cup, dog-table, deer-clock. The one stimulus item cards were also white 3" x 5" cards, and each of the eight cards had one black line drawing of an animal. The same animals were used in each series of cards (fish, cat, horse, camel, monkey, bear, dog, deer).

A board 7" x 9" on which drawings of the eight animals were arranged in a circle was used in the assessment of central recall. Another board, the same size, on which the drawings of the eight household objects were arranged in a circle was used in assessing incidental recall; an eight page booklet was also used.

Procedure: Ss were tested individually. S was seated at a table across from E and instructed to look at the animals on the circular board. The stack of cards was shown, and S was told that the animals on the board were also on the cards. S was told that he would be shown a series of eight cards, one at a time, and that after each card was shown it would be placed before him, face down in a row. E then said he would point to one of the animals on the board and S should point to the card on the table which had the same animal on it. In addition, in the label condition, he was instructed to say the name of the animal on each card as it was shown and to say the name of the animal as E pointed to it on the board.

E showed S each card for approximately two seconds and placed it face down on the table. After the eight cards were shown, E pointed to one animal on the board and S then pointed to a card. Then the cards were picked up, and the procedure was repeated fifteen

times, for a total of 16 trials, divided into two series of eight. On each trial of a series, S was asked to find a different animal, and over the course of eight trials, S was required to find one card at each serial position. This constituted the central task.

Twenty Ss were first tested on a series (eight trials) of cards with one stimulus and then on a series of cards with two stimuli. The other twenty Ss were first tested on a series of cards with two stimuli and then a series of cards with one stimulus.

Before the series in which two stimuli appeared on a card, all Ss were instructed to ignore the extra item (household item). Ss in the label group were requested to label only the central item (animal). The procedure described above was carried out. Then Ss were given the booklet containing the animal pictures and the circular board with the pictures of the household objects on it. Ss were told to look at the booklet one page at a time and to say the name of the household object that had been paired with each animal. This incidental recall measure always occurred immediately after the series of cards with two stimulus items.

No feedback was given, but Ss were told their scores at the end of the experiment. The score on the central task was the number of animals correctly recalled. The score on the incidental task was the number of correct pairings of household object and animal.

Results: Table 1 presents the mean scores for each condition. A two-way analysis of variance with repeated measures on one factor (one stimulus versus two stimuli) was performed. There was a significant effect of labeling ($F = 5.16$, $p < .05$); but there was no significant effect of one versus two stimulus items ($F < 1$) and no significant interaction ($F < 1$).

Insert Table 1 about here

Serial position curves were examined. The label versus no label conditions were plotted (Fig. 1). Serial positions 1 and 2 refer to the first items presented to S (primacy), and serial positions 7 and 8 refer to the last two (recency) items presented. Serial position curves were also plotted separately for one picture versus two pictures, label and no label, groups (see Fig. 2).

Insert Figures 1 and 2 about here

A t-test was performed to compare the variability in the label condition versus that in the no label condition. At each serial position within each group a difference score was obtained which represented the absolute value of the difference of one versus two stimuli. These difference scores were then compared. The no label group was found to have greater difference scores than the label group ($t = 2.273$, $df = 7$, $p < .05$).

The incidental learning scores were examined for both the label and no label groups (Table 1). There was no significant difference in incidental learning for label versus no label conditions ($t < 1$). The incidental scores were therefore combined across groups. Incidental recall was higher than would be expected by chance ($t = 4.65$, $df = 39$, $p < .01$).

A number of correlations were carried out. The correlation over all Ss between two pictures per card central and incidental performance scores was -.34, ($t = 2.33$, $df = 38$, $p < .05$). Correlations between central and incidental learning were performed for the label and no label groups. For the label group the correlation was -.22 (n.s.). For the no label group the correlation was -.46 ($t = 2.19$, $df = 18$, $p < .05$).

Correlations were also computed between central learning scores and SAT verbal scores. SAT scores were obtained for seventeen of the twenty Ss in the no label group and for eighteen of the twenty Ss in the label group. The central scores for the correlation were a combined total of a S's one stimulus and two stimuli conditions. The correlation between central scores and SAT verbal scores was -.02 for the label group. The correlation between central scores and SAT verbal scores for the no label group was .38. This correlation was not significant ($t = 1.58$, $df = 15$, $p < .05$). The difference in the verbal SAT central task correlation for the label versus the no label group was not significant ($z = 1.13$). The correlation between central scores and SAT mathematical scores for the label group was -.06. For the no label groups this correlation was .51 ($t = 2.27$, $df = 15$, $p < .05$). There was a higher correlation in the no label group than in the label group between central recall scores and SAT mathematical scores ($z = 1.66$, $p < .05$, 1 tail).

Discussion: The finding that labeling decreased performance in a serial position recall task for adults supplements the past research in this area. Hagen and Meacham (1967) hypothesized that their older children were not helped by labeling because they had developed strategies which involved covert rehearsal. The present study supports a view that with age the use of rehearsal strategies becomes increasingly dominant. Thus induced, labeling becomes more detrimental.

Three types of evidence indicate that labeling inhibits use of more efficient processing. Evidence for the greater use of complex strategies in the no label group is suggested by the data of Figure 2. The no label conditions for one versus two stimuli show more variability than the label conditions. It seems that labeling inhibits individual strategies and forces more similarity among Ss in task strategies.

Correlations between central and incidental scores further support the hypothesis that labeling interferes with the way the task is performed. Hagen (1967) found increasingly negative correlations between central and incidental recall as a function of CA. He argues that as a child becomes older, he becomes a more efficient information processor and thereby is better able to disregard the incidental material and concentrate on the central task. In the present study the overall correlation (-.34) between central and incidental recall was significant. This result was expected since college students are assumed to be more efficient information processors than 14 year olds. The label and no label conditions examined separately show an interesting result. There is a significant negative correlation, -.46, in the no label group between central and incidental performance, but the correlation in the label group is -.22. This finding suggests that the labeling procedure affects ability to selectively attend to relevant stimuli. Hagen (1967) found that when a distractor task was added the correlations between central and incidental task performance disappeared. Verbal labeling thus is functionally equivalent to an imposed distracting condition.

A third finding also supports the hypothesis that labeling interferes with the use of individual rehearsal strategies. In the Hagen and Meacham (1967) study the correla-

tion between central performance scores and intelligence test scores was significant in older Ss. A similar correlation between central scores and SAT scores was thus expected. For the no label condition it was found in this study also (verbal .38; mathematical .51). Ss who are not required to label are free to use their own strategies. High scorers on the SAT test have more efficient strategies and thus score higher on this task. In the label condition there was no indication of any correlation between central recall performance and SAT scores (verbal -.02; mathematical -.06). Required labeling seems to cause conformity in the approaches used. High scorers on the SAT lose the advantage of their own strategy and do no better on this task than low scorers on the SAT.

The three findings are of course not conclusive. However, taken together, they do indeed support the notion that labeling interferes with preferred strategies and produces task performance that is more under experimental control.

These conclusions call for new interpretations of the results of Atkinson, Hansen and Bernbach (1964) and Bernbach (1967). Atkinson et al. found that there is no primacy effect in serial position learning for four and five year olds in a very similar paradigm as was used in this study. They asked why the curves of these young children show no primacy when ten year olds' serial position curves do show primacy. Bernbach attempted to show that requiring four and five year olds to overtly label increased their primacy recall scores. He concluded that labeling in young children made their serial position curves look more like the serial position curves of older children and of adults which show primacy effects, although he did not actually test for significance. Bernbach says labeling makes rehearsal possible, and rehearsal increases primacy learning. Adults label automatically, according to Bernbach, and therefore they show high primacy learning. While labeling does facilitate short-term memory in children at certain ages, the present study should alert investigators that the acts of labeling and rehearsal are more complex than Bernbach suggests. Adults are doing something more involved than merely saying names. If they were simply labeling, then overt labeling should not hinder their performance. Bernbach's conclusion that the difference "between the short-term memory

performance of children and adults that was observed by Atkinson et al. may be traced to the effects of labeling on short-term memory, rather than to any inherent difference in the memory processes of children and adults" does not seem warranted (p. 150).

Finally, another look at the effect of two stimulus items has interesting implications. Hagen (1967) and Hagen and Meacham (1967) have found significant differences in central recall performance in one versus two stimulus items conditions in children. They attributed this to a general lack of processing ability. In the present study there was no such difference in central learning in the two conditions, and one may conclude that the college Ss were better able to ignore the incidental information. However, there was some incidental learning, for the incidental scores were significantly above chance. Although the presence of an extra stimulus item was not detrimental to performance, Ss were not able to completely ignore it.

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Table 1

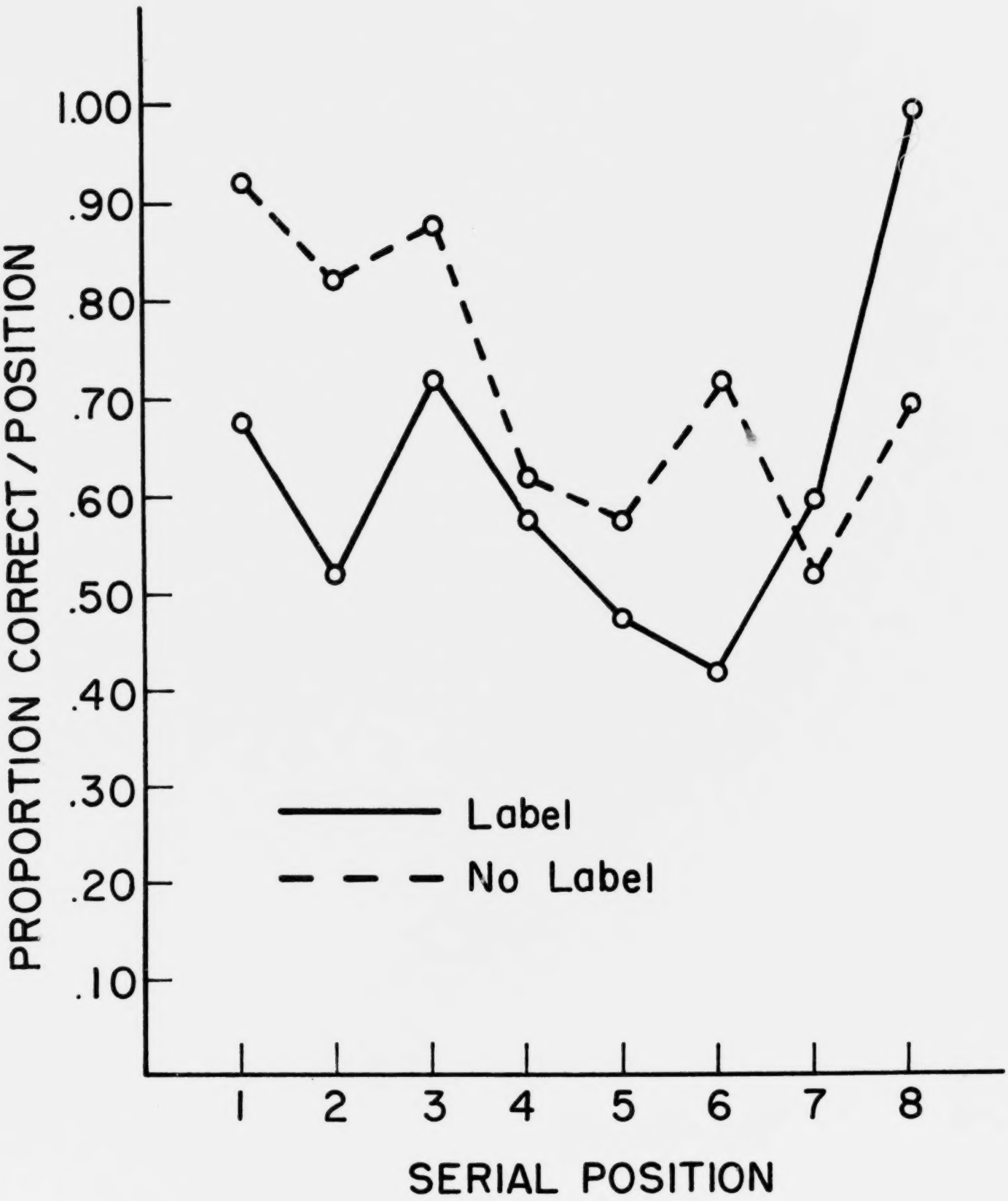
Mean Task Score for Each Condition

	1 Stimulus	2 Stimuli	Total	Incidental
Label	5.05	4.95	5.00	2.35
No Label	5.90	5.65	5.78	2.30
Average	5.48	5.30	5.39	2.32

Figure Captions

Figure 1. Proportions of correct responses as a function of serial position and experimental group.

Figure 2. Proportions of correct responses as a function of serial position and experimental group.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.40
.30
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Label
No Label
1
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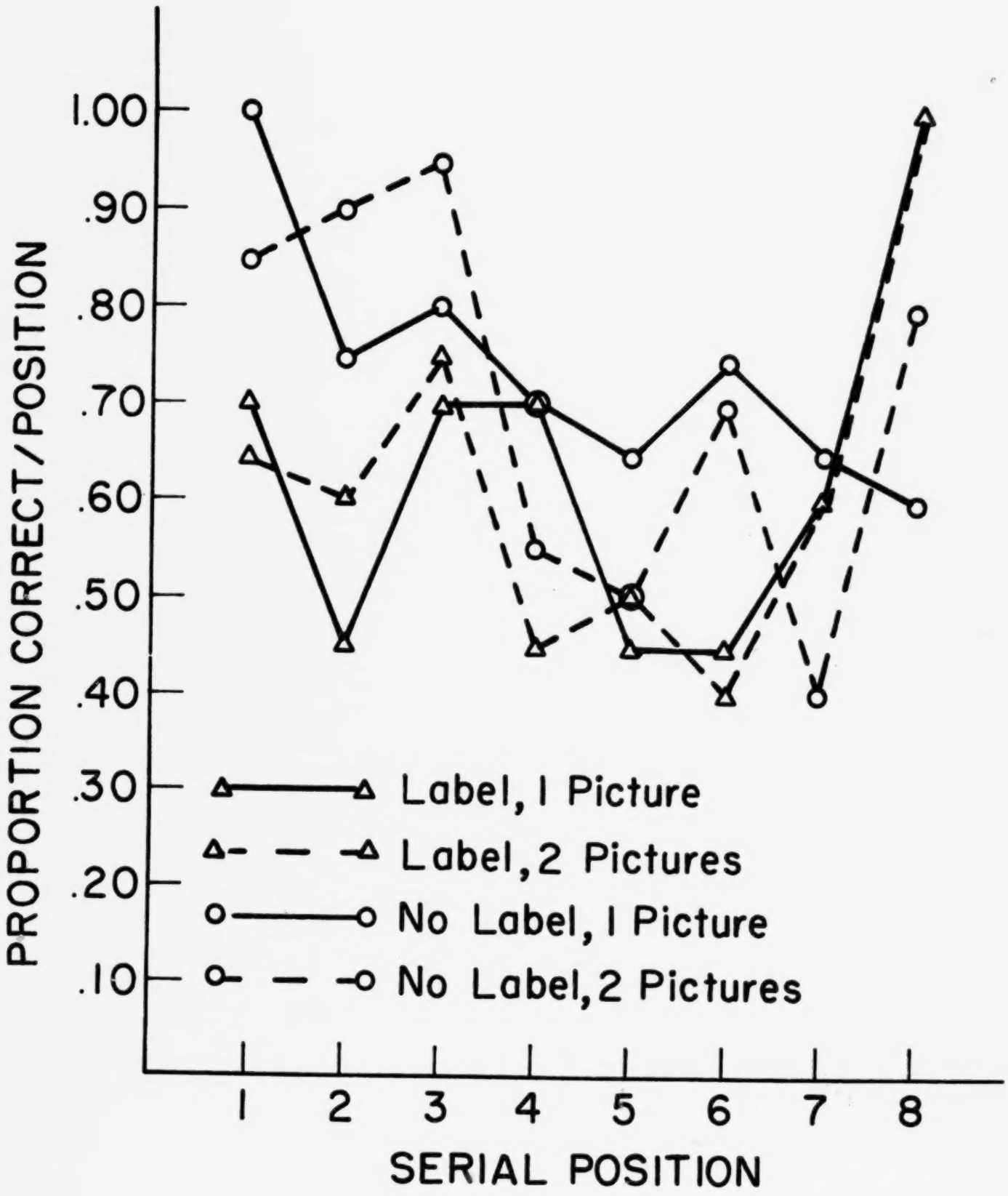
3
4
5
6
7
8
SERIAL POSITION

Fig. 1


PROPORTION CORRECT/POSITION
1.00
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Label, 1 Picture
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SERIAL POSITION

Fig. 2